Modeling and Testing the Effects of Texture and Plastic Deformation on Magnetic Properties

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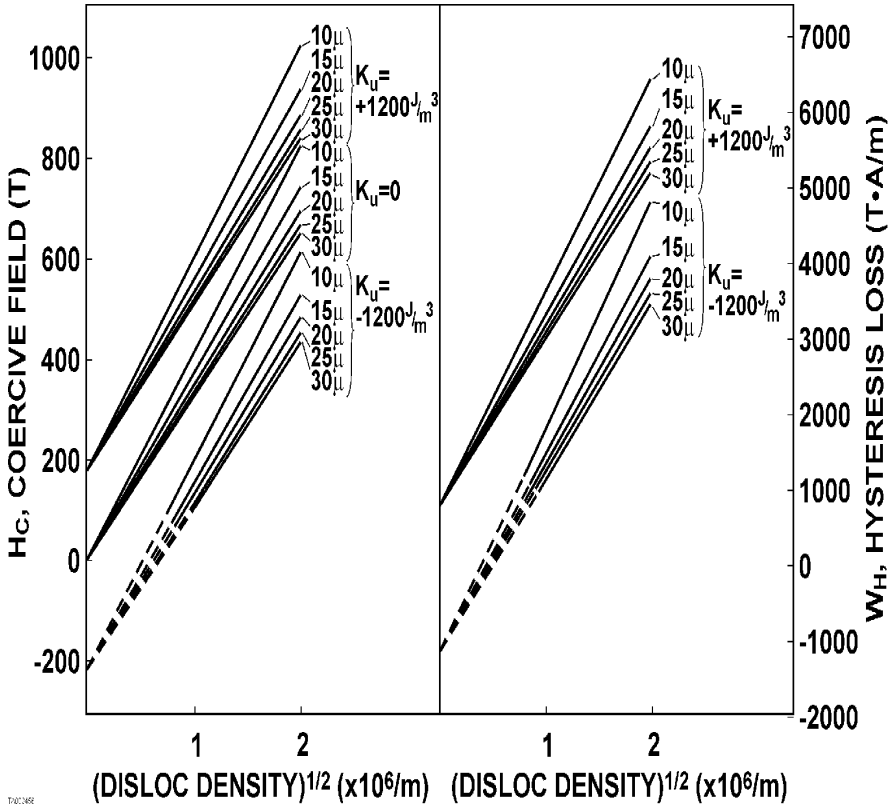
As part of the InterAmerican Materials Collaborative program, this researrch program joins an established magnetic hysteresis modeler and a magnetic thins films expert with a metallurgist working on bulk magnetic materials in Brazil. The aim is to develop a physical understanding of the effect of plastic deformation and texture anisotropy on magnetic properties of ferromagnetic polycrystalline materials, both in bulk and film form, and also to develop quantitative hysteresis models that predict such magnetic properties. The modeling will be accompanied by measurements on bulk and film. Initial modeling gives plots at right.



. Plots of (a) coercive field and (b) hysteresis loss against $\zeta_d^{1/2}$ (where ζ_d is dislocation density) for different grain sizes and different anisotropies K_u Different anisotropies produce different intercepts.

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The magnetic film effort is also starting. Films are being made using radical assist-dual ion beam sputtering (RA-DIBS). A collaboration with **Proto Mfg., Ltd** will address extraction of the dislocation density from XRD data to assist hysteresis modeling. A four point bending apparatus will be used for film deformation A sensitive, donated Lakeshore 7304 VSM will be used for hysteresis measurements.

Education:

Two undergraduates (Jonathan Garcia, and Jesse Contreras), one graduate students (Steven Rios), and one postdoc (Anup Bandyopadhyay) contribute to this work.

Outreach:

Brazilian postdoctoral fellow Taeko Yonamine has come to SwRI on an exchange basis for six weeks. Dr. Yonamine is at IPT in Sao Paulo, Brazil and works with Dr. Fernando Landgraf, who is the Latin American collaborator, and who is the metallurgist working on bulk magnetic materials. Dr. Yonamine is a physicist, who is now assisting with modeling of plastic deformation effects on magnetic properties. Later in the year, a graduate student from Texas State Univ. will also work at SwRI on modeling and Dr. Sablik will travel to Brazil to interact with Dr. Landgraf's group. In future years, a student of Dr. Roger Doherty (Drexel) will work briefly at SwRI on modeling. .